Docket Number: 081468-0356680
Client Reference: P-1823.020-US

IFW AF#1

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

OPAP AUG 1 9 2010 IAP19 PATENT & TRADEMARK OFFICE

In Re the Application of

Hans van der Laan, *et al.*

Application No.: 10/590,352

Filed: May 21, 2007

Group Art Unit: 2877

Examiner: Tri T. Ton

Confirmation No.: 8164

For: METHOD TO DETERMINE THE VALUE OF PROCESS PARAMETERS BASED ON SCATTEROMETRY DATA

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This Appeal is from the Final Office Action mailed February 19, 2010 (hereafter "Office Action"), rejecting claims 1-12, 16, 18-20, 22-33, 37, and 39-41 of the above-identified patent application. This brief is in furtherance of the Response to Non-Final Office Action filed November 25, 2009.

The Director is hereby authorized to charge the $540.00 for filing an Appeal Brief pursuant to 37 C.F.R. § 41.20(b)(2). The Director is further authorized to charge any additional fees that may be due, or credit any overpayment of same to Deposit Account No. 033975 (**Ref. No. 081468-0356680**).

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REQUIREMENTS OF 37 C.F.R. § 41.37

I. REAL PARTIES IN INTEREST (37 C.F.R. § 41.37(c)(1)(i))

The real party in interest in this appeal is the following party: ASML Netherlands B.V., by way of an Assignment recorded May 21, 2007, in the U.S. Patent and Trademark Office at Reel 019400, Frame 0057.

II. RELATED APPEALS AND INTERFERENCES (37 C.F.R. § 41.37(c)(1)(ii))

Appellant is unaware of any related appeals and/or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS (37 C.F.R. § 41.37(c)(1)(iii))

Pending:	Claims 1-16, 18-20, 22-37 and 39-41 are pending.
Withdrawn:	No claims have been withdrawn.
Canceled:	Claims 17, 21, 38 and 42 are canceled.
Rejected:	Claims 1-12, 16, 18-20, 22-33, 37 and 39-41 stand rejected.
Objected:	Claims 13-15, and 34-36 were objected to.
Allowed:	No claims have been allowed.
On Appeal:	Claims 1-12, 16, 18-20, 22-33, 37 and 39-41 are on appeal.

IV. STATUS OF AMENDMENTS (37 C.F.R. § 41.37(c)(1)(iv))

No amendments have been filed subsequent to the Final Office Action mailed February 19, 2010.

V. SUMMARY OF CLAIMED SUBJECT MATTER (37 C.F.R. § 41.37(c)(1)(v))

The following explanation of the claimed subject matter, with reference to the specification and drawings, is for explanation only and is not to be construed, in any way, as an admission that the claims are limited to the particularly disclosed embodiments. Rather, such description is intended to facilitate an understanding of the claims by the Board and is absolutely not intended to operate a comprehensive claim construction. The invention is not limited to the disclosed embodiments. References to the specification and drawings are exemplary only, and other parts or elements of the specification and drawings may be applicable.

1. Independent Claim 1

The invention of claim 1 concerns a method for determining at least one process parameter in a device manufacturing process. (*See generally* Figure 4). The method includes: obtaining calibration spectral measurement data (*See* Figure 2; Figure 9: scatterometer 902; ¶ [0059, page 13, lines 12-14) from a plurality of calibration marker structure sets (Figure 2: structure 5) provided on a calibration object (Figure 2: substrate 3), each of said plurality of calibration marker structure sets comprising at least one calibration marker structure (*See* Figures 8a and 8b; ¶¶ [0071]-[0073], page 16, line 7 – page 17, line 17), calibration marker structures of different calibration marker structure

sets being created using different known values of said at least one process parameter (*See* ¶ [0072], page 16, lines 26-28); determining a mathematical model (*See* ¶ [0059], page 13, lines 7-8) by using said known values of said at least one process parameter and by employing a multi-variant regression technique on said calibration spectral measurement data (*See* ¶ [0060], page 13, lines 7-9), said mathematical model comprising a number of regression coefficients (*See* ¶¶ [0063]-[0064], page 14, lines 13-32); obtaining spectral measurement data from at least one marker structure provided on an object (*See* ¶ [0061], page 13, lines 29-31), said at least one marker structure being made using an unknown value of said at least one process parameter; comparing the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model (*See* ¶ [0055], page 12, lines 18-19; ¶ [0061, page 13, line 27-33); and adjusting a control parameter of a lithographic apparatus based on the unknown value of said at least one process parameter for said object in the device manufacturing process (*See* ¶ [0061], page 13, line 33 – page 14, line 3).

2. <u>Independent Claim 22</u>

The invention of claim 22 concerns a system for determining at least one process parameter. (*See generally* Figure 9). The system includes a detector (*See* Figure 2; Figure 9: scatterometer 902; ¶ [0059, page 13, lines 12-14) arranged to obtain calibration spectral measurement data from a plurality of calibration marker structure

sets (Figure 2: structure 5) provided on a calibration object (Figure 2: substrate 3), each of said plurality of calibration marker structure sets comprising at least one calibration marker structure (*See* Figures 8a and 8b; ¶¶ [0071]-[0073], page 16, line 7 – page 17, line 17), calibration marker structures of different calibration marker structure sets being created using different known values of said at least one process parameter (*See* ¶ [0072], page 16, lines 26-28). The system also includes a processor unit (*See* Figure 9: Control unit 903; ¶ [0080], page 18, lines 29-30) storing a mathematical model determined by using said known values of said at least one process parameter and by employing a multi-variant regression technique on said calibration spectral measurement data, said mathematical model comprising a number of regression coefficients (*See* ¶¶ [0063]-[0064], page 14, lines 13-32). The processor unit is arranged to obtain spectral measurement data from at least one marker structure provided on an object (*See* ¶ [0061], page 13, lines 29-31), said at least one marker structure being made using an unknown value of said at least one process parameter; and to compare the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model (*See* ¶ [0055], page 12, lines 18-19; ¶ [0061, page 13, line 27-33).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL (37 C.F.R. § 41.37(c)(1)(vi))

Appellant is appealing:

1) The rejection of claims 1-12, 16, 18, 19, 22-33 and 37-40 under 35 U.S.C. §102(e) as allegedly being taught by U.S. Patent Application Publication No. 2003/0048458 to Mieher, *et al.* (hereinafter "Mieher"); and

2) The rejection of claims 20 and 41 under 35 U.S.C. §103(a) as allegedly being unpatentable over Mieher in view of U.S. Patent No. 6,917,901 to Bowley, Jr., *et al.* (hereinafter "Bowley").

VII. ARGUMENT (37 C.F.R. § 41.37(c)(1)(vii))

1. The rejection of claims 1-12, 16-19, 22-33 and 37-40 under 35 U.S.C. §102(e) over Mieher.

Under 35 U.S.C. § 102, "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Independent Claims

A. Claim 1

The rejection of claim 1 is improper for at least the reason that Mieher does not teach all of the features of the claimed invention.

In particular, Appellant submits that the cited portions of Mieher do not teach or suggest a method for determining at least one process parameter in a device manufacturing process that includes determining a mathematical model by using known values of at least one process parameter and by employing a multi-variant regression technique on the calibration spectral measurement data, the mathematical model comprising a number of regression coefficients; and comparing the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model, as recited in claim 1.

i. Shape Parameter Information is not Spectral Measurement Data

Claim 1 recites determining a mathematical model by using known values of at least one process parameter and by employing a multi-variant regression technique on calibration spectral measurement data.

The rejection takes the position that shape parameter information is a type of spectral measurement data and that therefore Mieher's operation on shape parameter

information anticipates Appellant's recited spectral measurement data. *See* Office Action, page 3.

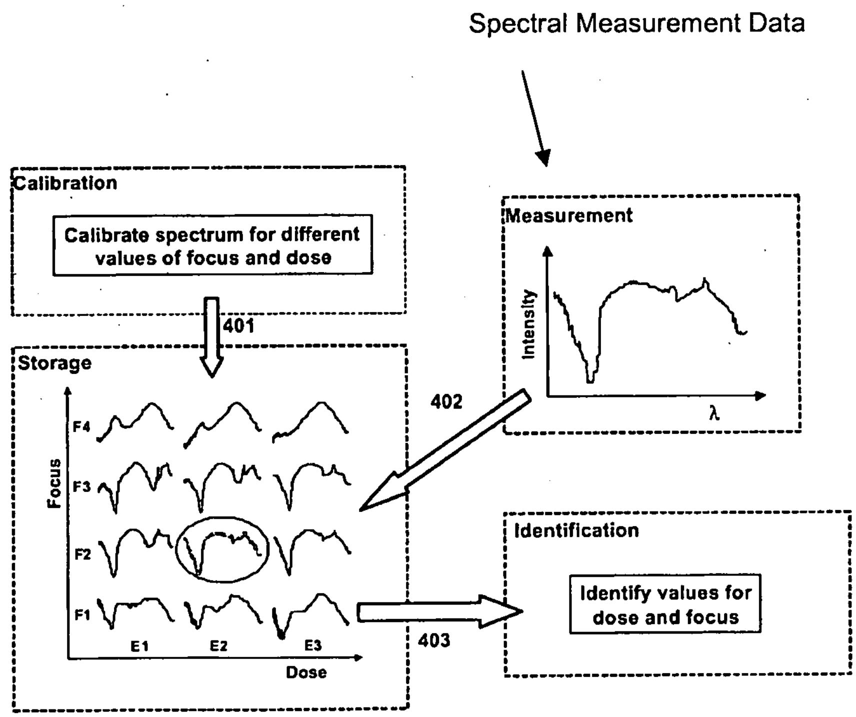
Appellant appreciates that during patent examination, the pending claims should be given their broadest reasonable interpretation in light of the specification as it would be interpreted by one or ordinary skill in the art. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005). However, the "broadest reasonable interpretation" is not simply the broadest interpretation, it is constrained by three conditions. It must be reasonable, it must be consistent with the specification and it must be consistent with the understanding of one of ordinary skill in the art. See, MPEP 2111.

Looking first to Appellant's specification, Appellant submits that one skilled in the art having read Appellant's disclosure would understand that shape parameter information is <u>not</u> the same as spectral measurement data. For instance, according to Appellant's disclosure, spectral measurement data refers to a distribution of radiation (light) energy arranged by wavelength reflected from a marker. [*See, e.g.*, Appellant's Specification, ¶ 47 ("The light beam 2 reflects and/or diffracts at the suitable structure 5 positioned on the surface of the substrate W. The spectrum of the reflected light beam is detected by the detector 4."); ¶ 37 ("FIG. 4 depicts a functional flow of a library-based method using measured calibration spectra"); Figure 4 (showing plot of intensity vs. wavelength (λ))]. Structural (or shape) parameters refer to physical parameters of the calibration marker. [*See, e.g.*, Appellant's Specification, ¶ 49 (" ... structural parameters like line width, line height, side wall angle etc. of the line of structure 5....")].

Appellant's specification clearly does not consider them to be the same and any interpretation that holds otherwise is not consistent with the specification as required.

Further, Appellant submits that the Office mischaracterizes the teachings from Appellant's Specification. The cited portions of Appellant's Specification simply do not describe "spectral measurement data being interpreted into shape parameter information," as the Office contends. Rather, as shown in the annotated Figure 4 of Appellant's Specification (reproduced below), spectral measurement data is clearly shown as a plot of intensity vs. wavelength (λ). With regards to reference element 402, Appellant's Specification expressly states: "This <u>*measured spectrum*</u> is then compared in task 402 with <u>*the spectra*</u> stored in memory 10." [Appellant's disclosure, ¶ [0055], emphasis added].

Fig 4



Next, looking to the teaching of Mieher as being an example of usage of one of ordinary skill in the art, it is clear that he likewise considers shape and spectra to be different. In particular, Mieher teaches that measured spectra, "generally includes intensity, polarization, phase and wavelength information associated with each site." [Mieher, ¶ 79, emphasis added]. On the other hand, with regard to shape parameters, Mieher teaches:

> The shape parameters are generally associated with the shape of a structure disposed on a wafer (e.g., a target structure or some portions of a device structure). The structure may be in the form of a grating that is typically periodic. The grating may be periodic in one direction (X or Y), as for example a line space grating, or it may be periodic in two directions (X and Y), as for example a grid space grating. The shape parameters may include line width (width at a specific height), side wall angle, height, pitch, top-profile (degree of top rounding or T topping), bottom profile (footing) and the like. The shape parameters may also include 3 dimensional shape information of structures that are periodic in both X and Y directions (as in grid space gratings).
>
> [Mieher, ¶ 32, emphasis added].

Thus, it quite apparent from Mieher's disclosure that the shape of the structure (i.e., shape information) and light scattered, reflected and/or diffracted from the structure (i.e., measured spectra) are clearly not the same nor equivalent to each other. To conclude otherwise, as the Office has done, directly contravenes the express teachings of Mieher.

In view of the available evidence, one of ordinary skill in the art would not, in view of Appellant's specification, reasonably construe "spectral measurement data," as "shape parameter information."

ii. Mieher's Regression Analysis is not the Recited Regression Analysis

Claim 1 recites determining a mathematical model (i) by using known values of at least one process parameter _and_ (ii) by employing a multi-variant regression technique on the calibration spectral measurement data. Both steps (i) and (ii) are therefore, needed for "determining a mathematical model" in claim 1.

The Office Action asserts that paragraph [0080] of Mieher allegedly teaches "regression analysis of calibration spectral measurement data" and that paragraphs [0056-0060], [0061-0065] and [0066], lines 1-3, of Mieher allegedly teach "determining a mathematical model for determining unknown values of process parameters of an object in a device manufacturing process." [*See* Office Action, pages 2-3, emphasis in original omitted].

Appellant submits that the Office legally erred by separately addressing steps (i) and (ii) without consideration that both steps (i) and (ii) are recited in claim 1 as being used together for *determining a mathematical model.* That is, the mere mention of regression in one portion of Mieher and of a mathematical model in another portion does not add up to anticipation. Indeed, "unless a reference discloses within the four corners of the document not only all of the limitations claimed _but also all of the limitations arranged or combined in the same way as recited in the claim_, it cannot be said to prove prior invention of the thing claimed and, thus, cannot anticipate under 35 U.S.C. § 102." *Net MoneyIN, Inc.* v. VeriSign, *Inc. et al.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008) (emphasis added).

In fact, the cited portion of Mieher describing regression techniques does not relate to determining the mathematical model. To the contrary, the cited portions of

Mieher disclose that *"the scatterometry data (e.g., measured spectra) is interpreted into shape parameter information. This may be accomplished using iterative regression techniques* and/or by library matching techniques such as those previously described, i.e., match the measured spectra with libraries that link profiles with spectra." [Mieher, ¶ 80, emphasis added]. That is, Mieher's regression techniques are used solely for converting scatterometry data into shape parameter information, not for determining the mathematical model. As discussed above, shape parameter information is not the same as spectral measurement data.

Mieher also describes solving equations/solutions (which the Office Action asserts is a mathematical model[1]) to determine the focus-exposure dependencies of multiple shape parameters. [*See* Mieher, ¶¶ 56 and 60]. Again, the alleged mathematical model in Mieher is determined using shape parameter information – not using calibration spectral measurement data. While the Office states that paragraphs [0061] – [0065] and [0066], lines 1-3, of Mieher allegedly teach a mathematical model comprising a number of regression coefficients,[2] Appellant submits that this portion of Mieher does not appear to be linked in any way to the regression analysis of ¶80 (which was the process by which scatterometry data was converted into shape parameters).

ii. Mieher's Comparing is not the Recited Comparing

Independent claim 1 further recites "comparing the obtained spectral measurement data with the calibration spectral measurement data to determine the

1 See Office Action, page 5 ("equation model is not different from mathematical model")

unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model." (emphasis added). Mieher does not teach these features.

Instead, Mieher describes comparing shape parameter information – not measured spectra – to determine focus exposure conditions. [*See* Mieher, ¶ [0088] ("... the shape parameter information determined in block 154 is matched with focus-exposure dependencies of shape parameters to determine conditions used to process the measured wafer."); *see also* Figure 4: step 156]. In addition, as shown in Figure 13 of Mieher (reproduced below), the calibration spectral measurement data and the obtained spectral measurement data are each converted into shape parameters (steps 308 and 316) and then the resultant shape parameters are subsequently compared (step 318).

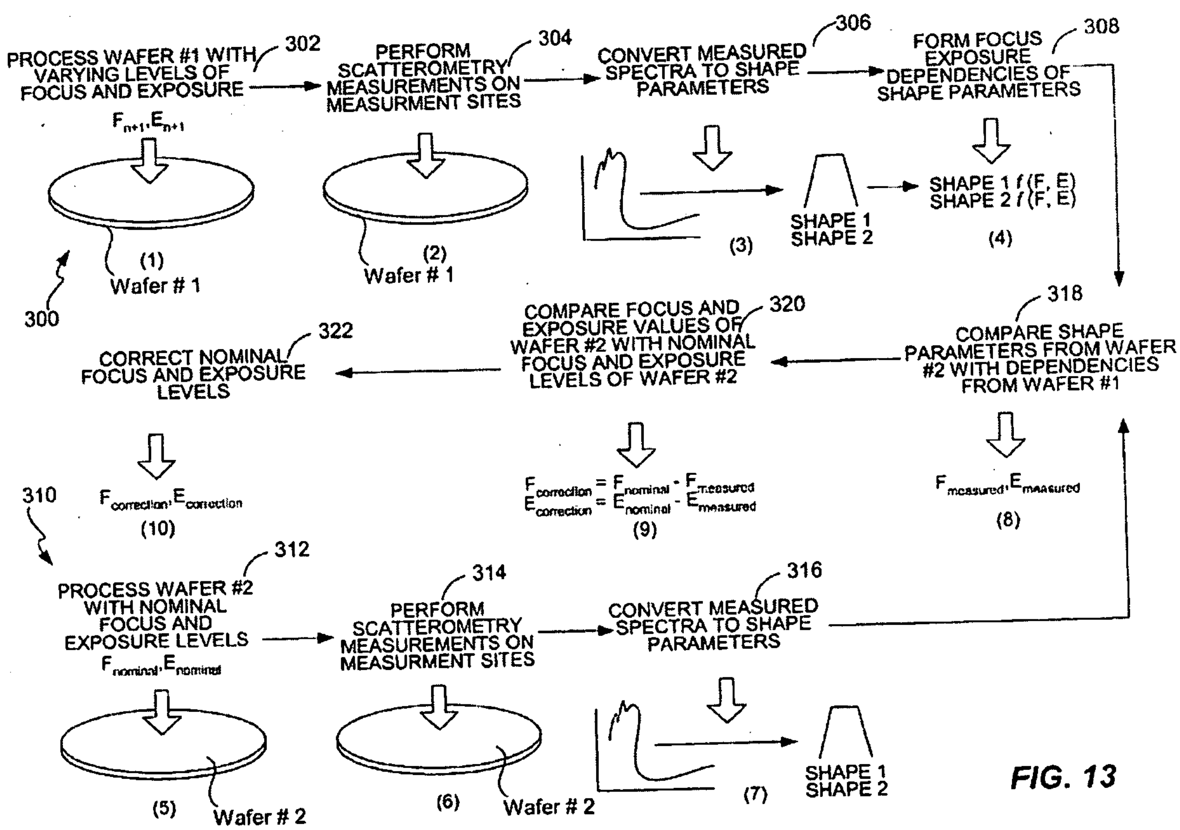


FIG. 13

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2 *See* Office Action, page 3.

By contrast, Appellant's claimed invention specifically compares spectral measurement data with the calibration spectral measurement data, rather than shape parameters. As such, the claimed invention does not convert spectral measurement data into shape parameters for subsequent comparison as the cited portions of Mieher teach.

Further, Appellant's claimed invention employs regression coefficients of a mathematical model based on spectral measurement data to determine an unknown value of a process parameter for an object. To the extent that the cited portions of Mieher teach using regression, they are used for a different purpose (i.e., to convert spectral data to shape parameter information). [*See, e.g.*, Mieher, ¶ 80, lines 1-3]

For at least these reasons, the rejection of claim 1 is improper and must be withdrawn.

B. Claim 22

The rejection of independent claim 22 is improper for at least the reason that the Mieher does not teach or disclose all the features of the claimed invention.

In particular, Appellant submits that the cited portions of Mieher do not disclose or teach a system for determining at least one process parameter comprising, *inter alia,* a processor unit storing a mathematical model determined by using said known values of said at least one process parameter and by employing a multi-variant regression technique on said calibration spectral measurement data, said mathematical model comprising a number of regression coefficients; said processor unit being arranged to

obtain spectral measurement data from at least one marker structure provided on an object, said at least one marker structure being made using an unknown value of said at least one process parameter; and to compare the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model, as recited in claim 22.

Thus, for reasons that should be quite apparent from the discussion of claim 1, above, the cited portions of Mieher do not teach or disclose each and every feature of independent claim 22, either.

* * *

Accordingly, for each of the foregoing reasons, Appellant respectfully submits that a case of anticipation has not been established and that the cited portions of Mieher fail to disclose or teach each and every feature recited in independent claims 1 and 22. Claims 2-12, 16, 18, 19, 23-33, 37, 39 and 40 ultimately depend from one of independent claims 1 and 22, and are therefore, patentable for at least the same reasons provided above related to claims 1 and 22, and for the additional features recited therein. Thus, Appellant respectfully requests that the rejection of claims 1-12, 16, 18, 19, 22-33, 37, 39 and 40 under 35 U.S.C. § 102(e) over Mieher should be withdrawn and the claims be allowed.

Dependent Claims

C. Claims 3 and 24

Claims 3 and 24 further recite that "said optical detector is a scatterometer." The Office Action states that "... *it is obvious* to have a scatterometry technique used to measure the grating structure having detected by using optical detector." [Office Action, page 7, emphasis added].

Appellant notes that the rejection of claims 3 and 24 was made under 35 U.S.C. § 102(e). Whether the subject matter of claims 3 and 24 is allegedly obvious, is immaterial to anticipation. Accordingly, Appellant submits that, as a matter of law, the Office has failed to establish that claims 3 and 24 are anticipated.

For at least the foregoing reasons, the rejection of claims 3 and 24 is improper and must be withdrawn.

D. Claims 4 and 25

Claims 4 and 25 further recite that "the multi-variant regression technique used by the mathematical model is selected from a group consisting of principal component regression, non-linear principal component regression, partial least squares modeling and non-linear partial least squares modeling."

The Office asserts that paragraph [0080], lines 7-14, of Mieher allegedly teaches claims 3 and 24. [*See* Office Action, page 7]. Appellant submits that the Examiner is incorrect for at least the following reasons. At best, the cited portions of Mieher appear only to mention iterative regression and that "[o]ne common method of iterative

regression is non-linear regression." [Mieher, ¶ [0080, lines 13-14]. Thus, Mieher only discloses non-linear regression, but does not disclose any of the claimed species of that genus (i.e., non-linear principal component regression, or non-linear partial least squares modeling).

For at least the foregoing reasons, the rejection of claims 4 and 25 is improper and must be withdrawn.

E. Claims 10 and 31

Claims 10 and 31 further recite "preprocessing [preprocess] the obtained calibration spectral measurement data and the obtained spectral measurement data before said employing said regression coefficients."

The Office asserts that paragraphs [0037], [0044] and [0080] of Mieher allegedly teach claims 10 and 31. [*See* Office Action, page 8]. Appellant submits that the Examiner is incorrect for at least the following reasons.

Paragraph [0037] of Mieher generally discloses printing structures using process parameters, determining the shape parameters associated with the parameters and correlating the shape parameters with the process parameters (so as to form dependencies). Paragraph [0044] of Mieher discloses scattermometry (i.e., obtaining measurement data). Thus, neither paragraph [0037] nor paragraph [0044] of Mieher teaches *preprocessing* obtained calibration spectral measurement data before employing regression.

Further, while paragraph [0080] of Mieher discloses interpreting scatterometry data into shape parameter information, a regression technique is specifically used for

this step. There is no mention in paragraph [0080] of Mieher of preprocessing the scatterometry data before employing the regression technique.

For at least the foregoing reasons, the rejection of claims 10 and 31 is improper and must be withdrawn.

F. Claims 11 and 32

Claims 11 and 32 further recite that "said preprocessing comprises performing on said data at least one of the group of mathematical operations consisting of subtraction of a mean, division by standard deviation, selection of optical parameters and weighing of optical parameters, and wherein the optical parameters comprise at least one of the group of parameters consisting of wavelength, angle and polarization state."

The Examiner asserts that paragraphs [0003] and [0060] – [0068] of Mieher allegedly teaches claims 11 and 32. [*See* Office Action, page 8]. Appellant submits that the Examiner is incorrect for at least the following reasons. First, the cited portions of Mieher do not teach a claimed optical parameters (i.e., wavelength, angle and polarization state). Rather, they teach multiple space parameters (e.g., critical dimension, height and sidewall angle) which are related to a physical structure. Space parameters and not optical parameters.

Second, none of paragraphs [0060] – [0068] of Mieher appear to teach (i) subtraction of a mean, (ii) division by standard deviation, (iii) selection of optical parameters or (iv) weighing of optical parameters.

For at least the foregoing reasons, the rejection of claims 11 and 32 is improper and must be withdrawn.

G. Claims 12 and 33

Claims 12 and 33 further recite that "each of said plurality of calibration marker structure sets comprises at least a first and a different second calibration marker structure."

The Examiner asserts that paragraph [0008], lines 10-11 of Mieher allegedly teaches claims 11 and 32. [*See* Office Action, page 8]. Appellant submits that the Examiner is incorrect for at least the following reasons. The cited portions of Mieher refer to "one or more structures." However, the Office has not established that at least one of these structures of Mieher is of a different structure than another.

For at least the foregoing reasons, the rejection of claims 12 and 33 is improper and must be withdrawn.

H. Claims 18 and 39

Claims 18 and 39 further recite "a lithographic apparatus and a track."

The Examiner asserts that paragraph [0002] of Mieher allegedly teaches claims 18 and 39. [*See* Office Action, page 9]. Appellant submits that the Examiner is incorrect. While the cited portions of Mieher may refer to "a lithographic system," the Office has not shown that the cited portions of Mieher also teach a track.

For at least the foregoing reason, the rejection of claims 18 and 39 is improper and must be withdrawn.

* * *

For at least the foregoing reasons, the rejection of claims 1-12, 16, 18, 19, 22-33, 37, 39 and 40 under 35 U.S.C. §102(e) over Mieher is improper and must be withdrawn.

2. The rejection of claims 20 and 41 under 35 U.S.C. §103(a) in view of Mieher and Bowely.

A. Dependent claims 20 and 41

Even assuming *arguendo* that the cited portions of Mieher and Bowley are properly combinable (which Appellant does not concede), Appellant submits that the cited portions of Bowley do not overcome the deficiencies of Mieher.

For instance, the Office merely relies upon Bowley to allegedly show a support structure configured to support a patterning structure and a substrate table configured to hold the substrate.

Therefore, Appellant respectfully submits that a *prima facie* case of obviousness has not been established, and that the cited portions of Mieher, Bowley, or a proper combination thereof, fail to disclose or otherwise render obvious each and every feature recited in independent claims 1 and 22.

Claims 20 and 41 depend from claims 1 and 22, respectively, and are therefore, patentable for at least the same reasons provided above related to claims 1 and 22 and for the additional features recited therein. Thus, Appellant respectfully requests that the rejection of claims 20 and 41 under 35 U.S.C. § 103(a) over Mieher in view of Bowley should be withdrawn and the claims be allowed.

VIII. CLAIMS APPENDIX (37 C.F.R. § 41.37(c)(1)(viii))

Appendix A: The pending claims are attached in Appendix A.

IX. EVIDENCE APPENDIX (37 C.F.R. § 41.37(c)(1)(ix))

Appendix B: (None)

X. RELATED PROCEEDINGS APPENDIX (37 C.F.R. § 41.37(c)(1)(x))

Appendix C: (None)

CONCLUSION

For at least the foregoing reasons, Appellant respectfully requests that the rejections each of pending claims 1-12, 16, 18-20, 22-33, 37 and 39-41 be reversed.

Respectfully submitted,

Date: August 19, 2010

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APPENDIX A

CLAIMS

1. **(Previously Presented)** A method for determining at least one process parameter in a device manufacturing process, the method comprising:

obtaining calibration spectral measurement data from a plurality of calibration marker structure sets provided on a calibration object, each of said plurality of calibration marker structure sets comprising at least one calibration marker structure, calibration marker structures of different calibration marker structure sets being created using different known values of said at least one process parameter;

determining a mathematical model by using said known values of said at least one process parameter and by employing a multi-variant regression technique on said calibration spectral measurement data, said mathematical model comprising a number of regression coefficients;

obtaining spectral measurement data from at least one marker structure provided on an object, said at least one marker structure being made using an unknown value of said at least one process parameter;

comparing the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model; and

adjusting a control parameter of a lithographic apparatus based on the unknown value of said at least one process parameter for said object in the device manufacturing process.

2. **(Previously Presented)** The method according to claim 1, wherein said calibration measurement data and said measurement data are obtained with an optical detector.

3. **(Previously Presented)** The method according to claim 2, wherein said optical detector is a scatterometer.

4. **(Previously Presented)** The method according to claim 1, wherein the multi-variant regression technique used by the mathematical model is selected from a group consisting of principal component regression, non-linear principal component regression, partial least squares modeling and non-linear partial least squares modeling.

5. **(Previously Presented)** The method according to claim 1, wherein said object is a substrate.

6. **(Previously Presented)** The method according to claim 5, wherein the substrate comprises one of a group consisting of a test wafer and a product wafer.

7. **(Previously Presented)** The method according to claim 5, wherein the at least one marker structure is positioned on said substrate within one of the group consisting of a chip area and a scribe-lane.

8. **(Previously Presented)** The method according to claim 7, wherein the at least one marker structure is a part of a device pattern within a chip area.

9. **(Previously Presented)** The method according to claim 1, wherein the at least one marker structure comprises a diffraction grating.

10. **(Previously Presented)** The method according to claim 1, wherein the method further comprises preprocessing the obtained calibration spectral measurement data and the obtained spectral measurement data before said employing said regression coefficients.

11. **(Previously Presented)** The method according to claim 10, wherein said preprocessing comprises performing on said data at least one of the group of mathematical operations consisting of subtraction of a mean, division by standard deviation, selection of optical parameters and weighing of optical parameters, and

wherein the optical parameters comprise at least one of the group of parameters consisting of wavelength, angle and polarization state.

12. **(Previously Presented)** The method according to claim 1 wherein each of said plurality of calibration marker structure sets comprises at least a first and a different second calibration marker structure.

13. **(Previously Presented)** The method according to claim 12, wherein said first calibration marker structure comprises a number of non-patterned layers and said second calibration marker structure comprises the same non-patterned layers on top of which a pattern is provided.

14. **(Previously Presented)** The method according to claim 12, wherein said first calibration marker structure comprises a pattern with isolated lines and said second calibration marker structure comprises a pattern with dense lines or isolated spaces.

15. **(Previously Presented)** The method according to claim 12, wherein the first and second calibration marker structures are in close proximity to each other, such that a distance between the first and second calibration marker structure is in the same order of magnitude as a size of the first and second calibration marker structure.

16. **(Previously Presented)** The method according to claim 1, wherein at least one calibration structure within a calibration marker structure set and said marker structure have substantially comparable shapes.

17. **(Cancelled)**

18. **(Previously Presented)** The method according to claim 1, wherein said method is related to at least one of a lithographic apparatus and a track.

19. **(Previously Presented)** The method according to claim 18, wherein said at least one process parameter is selected from a group consisting of focus, exposure dose, overlay error, track parameters related to dose, variation of line width over reticle, variations from reticle-to-reticle, projection lens aberrations, projection lens flare, and angular distribution of light illuminating the reticle.

20. **(Previously Presented)** The method according to claim 18, wherein the lithographic apparatus comprises:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning structure, the patterning structure serving to impart the beam of radiation with a pattern in its cross-section;

a substrate table configured to hold a substrate; and

a projection system configured to project the patterned beam onto a target portion of the substrate.

21. **(Cancelled)**

22. **(Previously Presented)** A system for determining at least one process parameter, the system comprising:

a detector arranged to obtain calibration spectral measurement data from a plurality of calibration marker structure sets provided on a calibration object, each of said plurality of calibration marker structure sets comprising at least one calibration marker structure, calibration marker structures of different calibration marker structure sets being created using different known values of said at least one process parameter;

a processor unit storing a mathematical model determined by using said known values of said at least one process parameter and by employing a multi-variant regression technique on said calibration spectral measurement data, said mathematical model comprising a number of regression coefficients;

said processor unit being arranged to obtain spectral measurement data from at least one marker structure provided on an object, said at least one marker structure being made using an unknown value of said at least one process parameter; and to compare the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model.

23. **(Previously Presented)** The system according to claim 22, wherein said detector is an optical detector.

24. **(Previously Presented)** The system according to claim 23, wherein said optical detector is a scatterometer.

25. **(Previously Presented)** The system according to any of the claim 22, wherein the multi-variant regression technique used by the mathematical model is selected from a group consisting of principal component regression, non-linear principal component regression, partial least squares modeling and non-linear partial least squares modeling.

26. **(Previously Presented)** The system according to any of the claim 22, wherein said object is a substrate.

27. **(Previously Presented)** The system according to claim 26, wherein the substrate comprises one of a group consisting of a test wafer and a product wafer.

28. **(Previously Presented)** The system according to claim 26, wherein the at least one marker structure is positioned on said substrate within one of the group consisting of a chip area and a scribe-lane.

29. **(Previously Presented)** The system according to claim 28, wherein the at least one marker structure is a part of a device pattern within a chip area.

30. **(Previously Presented)** The system according to claim 22, wherein the at least one marker structure comprises a diffraction grating.

31. **(Previously Presented)** The system according to claim 22, wherein the processor unit is arranged to preprocess the obtained measurement data before said employing said regression coefficients.

32. **(Previously Presented)** The system according to claim 31, wherein said preprocessing comprises performing on said data at least one of the group of mathematical operations consisting of subtraction of a mean, division by standard deviation, selection of optical parameters and weighing of optical parameters, and

wherein the optical parameters comprise at least one of the group of parameters consisting of wavelength, angle and polarization state.

33. **(Previously Presented)** The system according to claim 22 wherein each of said plurality of calibration marker structure sets comprises at least a first and a different second calibration marker structure.

34. **(Previously Presented)** The system according to claim 33, wherein said first calibration marker structure comprises a number of non-patterned layers and said second calibration marker structure comprises the same non-patterned layers on top of which a pattern is provided.

35. **(Previously Presented)**The system according to claim 33, wherein said first calibration marker structure comprises a pattern with isolated lines and said second calibration marker structure comprises a pattern with dense lines or isolated spaces.

36. **(Previously Presented)** The system according to claim 33, wherein the first and second calibration marker structures are in close proximity to each other, such that a distance between the first and second calibration marker structure is in the same order of magnitude as a size of the first and second calibration marker structure.

37. **(Previously Presented)** The system according to claim 22, wherein at least one calibration structure within a calibration marker structure set and said marker structure have substantially comparable shapes.

38. **(Cancelled)**

39. **(Previously Presented)** The system according to claim 22, wherein said system comprises at least one of a lithographic apparatus and a track.

40. **(Previously Presented)** The system according to claim 39, wherein said at least one process parameter is selected from a group consisting of focus, exposure dose, overlay error, track parameters related to dose, variation of line width over reticle, variations from reticle-to-reticle, projection lens aberrations, projection lens flare, and angular distribution of light illuminating the reticle.

41. **(Previously Presented)** The system according to claim 39, comprising:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning structure, the patterning structure serving to impart the beam of radiation with a pattern in its cross-section;

a substrate table configured to hold a substrate; and

a projection system configured to project the patterned beam onto a target portion of the substrate.

42. **(Cancelled)**

APPENDIX B

EVIDENCE APPENDIX

NONE

APPENDIX C

RELATED PROCEEDINGS APPENDIX

NONE